NASA SBIR/STTR Technologies

H8.02-9280 - Long Life, High Energy Cell Development

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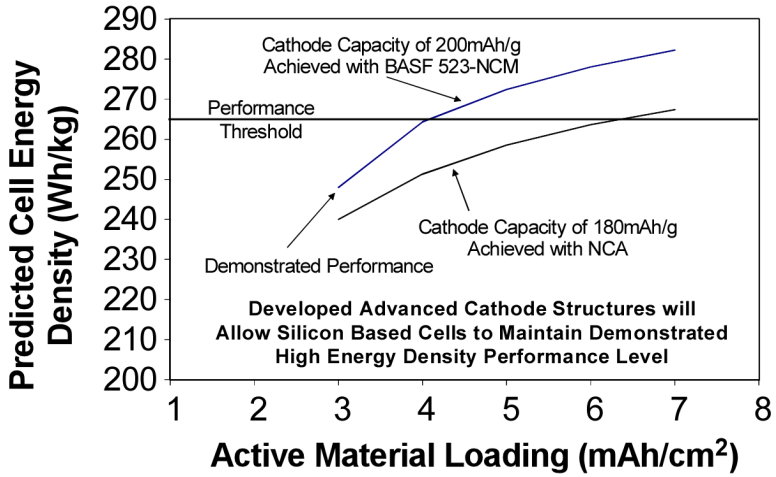
Identification and Significance of Innovation

NASA has a need to develop higher energy density battery systems to meet the power requirements of future energy devices. In this proposed Phase I program, PSI will develop an advanced cathode electrode structure that allows for the construction of lithium ion cells with long life and energy densities greater than 265Wh/kg. The novel cathode electrode will reduce detrimental reactions with the electrolyte at high voltages that reduce cycling efficiency and enhance performance fade. Initially, PSI will demonstrate the feasibility of the proposed approach by constructing and performing steady state cycling of lab sized silicon/cathode cells. This testing will highlight the ability to construct cells that can maintain their performance over hundreds of cycles. Scale-up of the optimized processes will then be carried out to support construction of prototype Ah sized cells and demonstrate MRL and TRLs of 4.



K-9347

Estimated TRL at beginning and end of contract: (Begin: 2 End: 4)

Technical Objectives and Work Plan

Work Plan:
During the proposed Phase I PSI will:
- Prepare baseline and advanced cathode electrodes.
- Measure the electrochemical performance in half-cells.
- Construct and characterize the performance of Si/cathode lab-scale cells.
- Scale-up the relevant preparation techniques.
- Construct and measure the performance of Ah sized Si/cathode cells.

Technical Objectives:
- Prepare coated cathode electrodes that deliver >98% of the capacity of the uncoated electrodes on C/2 discharge.
- Demonstrate cathode capacities of >180mAh/g-electrode and 95% capacity retention over 50 cycles.
- Construct Si/cathode cells at loadings that will enable energy densities of greater-than or equal to 265Wh/kg and demonstrate 90% capacity retention over 125 cycles.
- Produce 1.5Ah cells demonstrating cathode capacities of >180mAh/g-electrode and anode capacity of >1000mAh/g-Si composite.

NASA Applications

The proposed technology could be utilized in all battery applications. The advanced cathode structures would improve cell cycling performance extending the total energy available over a given mission lifetime.

Non-NASA Applications

The initial market for the proposed technology is military aerospace applications where space is limited and battery energy density and cycle life is critical. In addition, the technology also would be well suited to powering microdevices, such as remote sensing devices, that would benefit from the increased runtimes and reduced battery size enabled by the increased battery energy density.

Firm Contacts

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